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A Nursing Education Intervention for Delirium Prevention

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University of Nebraska Medical Center

College of Nursing

DOCTOR OF NURSING PRACTICE (DNP)

FINAL DNP PROJECT

A NURSING EDUCATION INTERVENTION ON DELIRIUM PREVENTION

By

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The final DNP project presented to the

Faculty of the University of Nebraska Medical Center College of Nursing

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DOCTOR OF NURSING PRACTICE

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LeAnn Holmes, DNP, APRN, FAANP

A Nursing Education Intervention on Delirium Prevention

Abstract

Background

At a large, tertiary care hospital in the Midwest, it had been anecdotally noted that delirium or acute encephalopathy cases were increasing. Specifically, inpatient neurology consultations for delirium were on the rise. This data had been confirmed by hospital administration. Delirium has been identified as a well-known problem in elderly, hospitalized adults—most notably in elderly, postoperative adults. It can cause a cascade of additional complications for elderly patients. Delirium prevention is known to be the best method to combat delirium incidence. Prevention has been proven to occur by way of non-pharmacologic, early interventions by nursing. Bedside nursing staff must be given the tools to initiate these interventions. A teaching intervention on delirium was developed as one of these tools to answer the PICOT question: Does an education intervention for bedside post-op nurses improve their delirium knowledge?

Objective

The purpose of this study was to build an education program to promote nursing delirium recognition in a midwestern, tertiary hospital's postoperative care units. The specific aims for this quality improvement project were: 1. Develop a delirium education program 2. Describe postoperative nurse's pre and post-test delirium knowledge as measured with a delirium knowledge test.

Methods

A delirium teaching intervention was developed utilizing key prevention techniques from the literature, including the Hospital Elder Life Program. The delirium pretest was administered. The teaching intervention was delivered to bedside nursing staff in a discussion format with case studies as well as time for questions and answers. A posttest was then administered to determine the efficacy of the intervention.

Results

A total of 25 participants attended the education sessions. Statistics were calculated for the group as a whole. The mean pretest score was 72.15% answers correct with a standard deviation of 15.59 and a standard error mean of 3.12. The mean posttest scores for the cohort were 93.38% with a standard deviation of 6.71 and standard error mean of 1.34. Pre- and post-scores were compared within the nurses with a paired t-test. Computed *t*-statistic was -7.352 for a *p* value of <.001, *d*=1.47. This demonstrated a large statistical significance and clinical difference from pre to posttest scores. A change score was calculated from pre to posttest of 21.23%. Independent t-test and Pearson's correlations were used to assess relationships between change scores, demographic variables, and outcomes. There was no difference in knowledge gained by educational preparation: $F(13,11) = 0.46$, $p=.91$, $n2 =.35$. Lastly, there was no difference in knowledge gained by years in the role: $r =.77$ (CI -.47, .34), $p =.72$.

Conclusions

Use of an education intervention on delirium prevention increased bedside nursing staff's knowledge, as measured immediately after the education. There was no difference in knowledge gained between the pre and posttest scores by years in the role. The findings of this pilot study are similar to findings from

the limited studies identified in the literature studying education interventions on nursing knowledge. This study could be expanded at the tertiary care facility and incorporate data from chart reviews to include delirium incidence before and after the teaching. Future recommendations would be to incorporate delirium education into the routine educational offerings required at the tertiary care hospital and affiliated rural facilities.

Introduction

Within a large, 640-bed, multi-campus hospital system, a trend of increased neurology consultations for delirium and acute encephalopathy was identified by members of the neuro-hospitalist team. This was confirmed by the hospital administration. A delirium task force or quality improvement team (QI) was initiated to address these concerns. With encouragement from the neuro-hospitalist team, the idea to do a pilot study to improve delirium incidence evolved. The research question developed was: does nursing knowledge of post-op delirium (risk factors and bedside interventions) improve after a teaching intervention compared to no teaching intervention? As part of a systematic review of the literature, delirium was defined as an acute change in the level of consciousness with hallmarks of fluctuating inattention (DSM-V, 2013). Delirium has been identified as a well-known problem in elderly, hospitalized adults—most notably in elderly, postoperative adults (Marcantonio, 2017). It can cause a cascade of additional complications for elderly patients, such as increased morbidity and mortality (Marcantonio, 2017; Pendlebury et al., 2015), as well as increased length of stay and increased costs (Leslie et al., 2005). Delirium prevention is known to be the best method to combat delirium incidence (Thom et al., 2019). Prevention has been proven to occur by way of non-pharmacologic interventions by nursing (Kukolja & Kuhn, 2021). For nursing staff to be knowledgeable about these non-pharmacologic interventions, they must first have access to delirium prevention education. The review of the literature identified a gap in research on nursing education to improve delirium care. The purpose of this pilot study was to build an education program on delirium prevention and to evaluate nurse's pre and posttest delirium knowledge. The Iowa Model of Evidence-Based Practice to Promote Quality Care was used to develop the pilot study's steps. A pretest/posttest design was utilized to determine nursing delirium knowledge before and after an education intervention consisting of didactic information including question/answer sessions on the postoperative nursing units.

Problem Statement

Delirium is a well-documented problem for hospitalized, elder, patients. Approximately one-third of hospitalized, general medical patients older than 70 have delirium as a hospital complication (Marcantonio, 2017). In addition, delirium is one of the most frequently encountered postoperative complications among older adults after major surgery (Marcantonio, 2017). At a large, tertiary care hospital in the Midwest, it had been anecdotally noted that delirium or acute encephalopathy cases were increasing. Specifically, inpatient neurology consultations for delirium were on the rise. This data had been confirmed by hospital administration and consequently, a delirium task force or quality improvement (QI) team was formed to help decrease delirium incidence. One major concern was that hospital length of stay was also increased for patients with delirium (S. Persson, personal communications, October 2022).

Delirium according to the Diagnostic and Statistical Manual of Mental Disorders (DSM-5) is an acute change in mental status with hallmarks of inattention and altered awareness that is fluctuating (American Psychiatric Association, 2013). Delirium cannot be attributed to an underlying neurocognitive disorder; but rather is due to an underlying clinical condition (Kukolja & Kuhn, 2021). The terms delirium and dementia indicate different disease processes; delirium is caused by an instigating factor or event. Its' hallmarks are as described above, whereas dementia is a gradually progressive, neurodegenerative disease affecting one or more of the cognitive domains (Francis & Young, 2021). Some researchers have proposed a different term for cognitive impairment in the perioperative period to capture both these disease states: Perioperative Neurocognitive Disorders (Evered et al., 2018). For this study, the term delirium will be used.

Delirium can cause a cascade of untoward outcomes including increased length of hospital stay, higher risk for additional complications, and an increased need for ongoing nursing care placement post-

acute care (Marcantonio, 2017). Postoperative delirium is also a significant risk for increased postoperative mortality (Pendlebury et al., 2015). A recent review of Medicare expenditures for patients diagnosed with perioperative neurocognitive disorders by Boone et al. found that there was an additional 17, 275 dollars paid out within the first year (post-acute care) (2020). Leslie et al. found in 2005 that hospitalized patients who develop delirium had 2.5 times the cost associated with their inpatient stay (2008). In a 2014 article by Inouye et al., it was reported that delirium costs over 164 billion dollars per year in the United States alone.

The importance of early recognition of delirium symptoms, a thorough evaluation of the patient, and treatment with pharmacologic and non-pharmacologic methods is recommended (Marcantonio, 2017). The standard of care for treating delirium is prevention through a multimodal approach including nonpharmacologic interventions (Thom et al., 2019). Non-pharmacologic interventions include such treatments as frequent re-orientation, cognitive stimulation, use of sensory aids, early mobility, and avoidance of immobility (Inuoye et al., 1999; Kukolja & Kuhn, 2021). All of these non-pharmacologic interventions require commitment and understanding from the primary, bedside nurse who is responsible for administering these measures. A scoping review by Zaou et al. found that education interventions to promote nursing knowledge on delirium prevention are insufficient (2024). Thus, would an education intervention for bedside post-op nurses geared towards recognition and early treatment of delirium improve nurses' knowledge and ultimately, decrease delirium frequency for post-op, elderly patients? In PICOT (patient/problem, intervention, comparison, outcome, time as described by Melnyk & Fineout-Overholt, 2019) format: Does nursing knowledge of post-op delirium (risk-factors and bedside interventions) improve after a teaching intervention compared to no teaching intervention? Will this in turn improve delirium incidence and improve outcomes such as length of stay, increased cost of hospitalization, and lastly, the need for increased resources such as specialty neurology consultations?

P Nursing knowledge of post-op delirium

I Teaching intervention on delirium prevention

C As compared to no teaching intervention

O Improvement in nursing delirium knowledge

T After a 30-60-minute learning session

Purpose/Aims

The purpose of this study was to build an education program to promote nursing delirium recognition. This program is to improve nursing identification of early signs and symptoms of postoperative delirium in a midwestern, tertiary, hospital's general/progressive postoperative care units. The specific aims for this quality improvement project were: 1. Develop a delirium education program 2. Describe postoperative nurse's pre and post-test delirium knowledge as measured with a delirium knowledge test.

Review of the Literature

Objective

The goal of this literature review was to identify research studies that described an education intervention to improve nursing delirium knowledge. The review was further narrowed to postoperative delirium knowledge specific to elderly patients. Inclusion criteria were an educational intervention or outcomes, patient descriptors, and delirium as an outcome. Exclusion criteria were non-hospitalized patients, critically ill patients, those that did not fit elderly criteria (under 50 years of age), non-human studies, and non-English language studies. Databases searched included CINAHAL (Cumulative Index of Nursing and Allied Health Literature), PubMed, and Embase. Pearling was utilized from the results of these three databases to expand on the results. Due to the paucity of research, dates were extended to research older than five years. See Appendix A for a diagram of the process for this literature review.

Education Interventions

Sixteen studies were included in the final literature review. Eighteen studies were initially identified based on the above search, with two studies discarded during the data extraction process as one was a study protocol and another was deemed redundant as it was a subgroup study of a larger trial that was included. Three systematic reviews (SRs)/meta-analyses, four randomized controlled trials (RCTs), four non-randomized controlled trials, and five additional studies (such as quality/process improvement) were included in the final review. See Appendix B for a table summarizing these studies.

The three SRs each included a large number of RCTs and thus, many subjects. All three concluded that there is moderate to strong evidence for multi-component interventions to decrease the incidence of delirium (Burton et al., 2021; Li et al., 2021; Siddiqi, et al., 2016). However, the only SR that commented on education as part of the interventions was by Li et al. (2021) and this was not in detail. Of the remaining 13 studies chosen for this systematic review, seven involved education as part of a multi-faceted approach to preventing and treating delirium.

- Lundstrom et al. included a four-day education course (2007).
- Lundstrom et al. incorporated a two-day education course (2005).
- Chuan et al.'s study involved a two-week education session (2020).
- Lundstrom et al.'s intervention was comprised of a two-week training session for nursing staff (1999).
- Reppas-Rindlisbacher only included a ten-minute teaching session (2021).
- Durst et al. mentioned staff education, but no detail given (2020).
- Layne et al. had a one-hour staff education session (2015).

Only three studies focused on nursing education as the sole intervention for decreasing delirium and so these are discussed in further detail. One of these was a RCT, by van de Steeg et al. which researched

an e-learning intervention for nursing staff as a way to improve delirium care. This was a four-hour course with monthly overviews given. Charts of 3,273 patients divided into two groups were reviewed, before and after the education intervention. Nurses scored significantly higher on delirium knowledge testing after the educational intervention. Following the intervention, delirium risk screening increased, use of the delirium tool increased (Delirium Observation Screening Scale), and the number of nursing interventions increased, significantly so. However, delirium diagnoses were recorded less often during the intervention (2014).

The other two studies that focused on nursing education as an intervention were quasi-experimental studies. The first was by Birge and Aydin (2017). This study looked at the effect of two 40-minute training sessions for medical intensive care nursing staff on delirium incidence. The sample included 23 nurses and 135 patients. Delirium was identified less often after the education intervention. However, the incidence of hypoactive delirium was higher than hyperactive delirium--more difficult to identify per the authors. There was an increase in correct recognition of delirium posttest, but it was not statistically significant (Birge & Aydin, 2017). The second quasi-experimental study was similar in that nursing and medical staff were given a one-hour education session on delirium as well as weekly tutorials and posters plus chart reminders. Participants were hospital staff (39 physicians and 35 nurses) and 255 elderly, general medical patients. Patient information was gathered pre and post-test to determine delirium rates and additional patient outcomes. Post-intervention, there was a decrease in delirium that was statistically significant. Medical staff knowledge increased objectively posttest. However, staff recognition of delirium pretest was described as poor and did not increase significantly after (Wand et al., 2014).

Results

In this literature review to answer the above PICOT question, a paucity of data was found on nursing education as an intervention to decrease delirium. Sixteen research studies were ultimately included in this review, however, only three studies looked at the effect of nursing education on nursing knowledge and delirium incidence for hospitalized, elderly, adult patients. Mixed results were obtained from those three studies. Seven studies contained nursing education as a part of the intervention. More research is needed to describe the effect of nursing education on nursing delirium knowledge. Increasing the amount, frequency, or type of nursing education may have a greater impact on nursing knowledge and thus, improve delirium incidence for this patient population.

Limitations for this literature review include time as this review was completed as part of coursework for a doctor-of-nursing practice (DNP) degree. Another limitation to consider is the utilization of various search engines; replicating the literature search posed some difficulty. Risk of bias could be considered significant as there is only one reviewer for this systematic review.

Theoretical Framework

The theoretical framework chosen for this pilot study was The Iowa Model of Evidence-Based Practice to Promote Quality Care. This framework was chosen for this project as it concisely reflects the anticipated steps for proceeding with a pilot study for an education intervention on nursing delirium knowledge. The Iowa Model framework was published by Marita Titler et al. in 1994 to help nurses with research utilization to improve patient care (Titler et al., 2001). The model was updated in 2001 and again in 2017 to reflect changes in healthcare (Titler et al., 2001; Buckwalter et al., 2017). See Appendix C for a diagram of the 2017 revised Iowa Model. This model includes these important steps: identify the problem or opportunity; describe the question or problem; form a team; review the available research—if a gap in knowledge is identified, then develop a research study and implement; add the change if beneficial; disseminate the results (Buckwalter et al., 2017).

Identify the Problem

The problem of frequent postop delirium in elderly patients arose during neuro-hospitalist team rounds involving routine consultations for delirium and encephalopathy on this patient cohort at a 600+ bed tertiary hospital. It was noted anecdotally that the number of these consults were increasing. In addition, many of these patients did not have evidence-based practice treatments for delirium (pharmacologic and non-pharmacologic measures) in place. This is a patient-specific issue according to the first step of the Iowa Model (Buckwalter et al., 2017). A delirium QI team had been already formed to address the problem of delirium. The QI team reported to the neurology team that delirium incidence had increased significantly since the Covid-19 pandemic. It was remarked that delirium was likely under-represented in the outcome data as the information was coming from electronic health record (EHR) coding. This coding is dependent on health care providers to correctly enter a diagnosis of delirium, acute encephalopathy, or similar. Financial repercussions of the increased delirium incidence had not yet been determined. A tentative plan from the delirium QI team was to introduce a delirium order set, a nursing care plan, and to review options for a delirium documentation scale. The QI team indicated that there was no place in the EHR for nursing staff to document a delirium scale except on the critical care units. Despite the plan for these initiatives, there was no specific goal for nursing education (D. Mongeon, S. Persson personal communication, October 2022). This raised the question, would nursing education on delirium improve nursing knowledge and potentially decrease delirium incidence over time? This was considered a priority problem by the inpatient neurology team.

State the Question

The most recent version of the Iowa Model describes stating the problem as the second step in the process of moving research into practice (Buckwalter et al., 2017). The problem of postoperative delirium in the elderly is multifactorial, and the initial goal of this project was to develop an intervention

to decrease postoperative delirium. During the literature review, many different options for decreasing delirium have been explored. One of the most well-known research studies is the HELP (hospital elder life program) program developed by S. Inouye et al. (1999) which focused on the six main risk factors for development of delirium with interventions specific to each. Inouye et al.'s research utilized an already-trained team of geriatric specialists to provide the interventions. This type of specialty team is not available at the tertiary care hospital where the delirium problem has been identified. Therefore, training nurses with education on delirium is the first step in the process of improving the problem. In PICOT (problem, intervention, comparison, outcome, and time) format, this is:

P Nursing knowledge of post-op delirium

I Teaching intervention on delirium prevention

C As compared to no teaching intervention

O Improvement in nursing delirium knowledge

T After a 30-60-minute learning session

Form a Team

For this situation, a QI team had already been developed to address the problem of increased delirium incidence. All members of the QI team could be considered a part of the team for this project to improve nursing delirium knowledge. The pharmacy director and QI RN have provided invaluable data demonstrating the need for a delirium education intervention. Important participants also include the bedside nursing staff on the postoperative units, the nursing manager and director for the unit, as well as the neuro clinical nurse specialist for the facility. All of these members of the care team have a vested interest in improving delirium outcomes. Due to the nature of this project (a pilot study as part of the

DNP course requirements), most of the tasks will be undertaken by this author, utilizing the above colleagues as resources.

Review Current Literature

The next step outlined by the Iowa Model is to collect available research on the problem in question and synthesize the data. Part of this process is to determine if data is lacking (Buckwalter et al., 2017). This process has been performed by working with the hospital's research librarian. The systematic review of the literature identified a gap in the research. Only a handful of studies were identified that focused on nursing education as an intervention to improve delirium and related outcomes. Since there is not sufficient data available, the next step is to perform a study (Titler et al, 2001).

Develop a Pilot Study

The pilot study allows the intervention to be performed on a small scale, in a real-life environment to determine effectiveness (Titler et al., 2001). The nurse manager for the postoperative general/progressive care unit agreed to have her staff participate in the education intervention. The hospital IRB research department gave consent without needing to do a formal application as there was no contact with patient charts or patients. The university affiliated with the DNP student approved the study without need for formal institutional review board (IRB) review. Nursing staff were required to give consent prior to starting the research. This pilot study included administration of a pretest to assess nursing bedside delirium knowledge, followed by a 30-minute-long didactic learning module on delirium signs and symptoms. This included information on early bedside nonpharmacologic interventions. Immediately following the education intervention, a posttest was administered which consisted of the same questions as the pretest. Pretest and posttest data were compared.

Integrate the Practice Change

If nursing delirium knowledge was determined to improve based on comparisons of pretest/posttest data, then the delirium education intervention could be adopted facility-wide. The Iowa Model suggests engaging key stakeholders again at this point in order to facilitate change (Buckwalter et al., 2017). Once the change is cemented, then ongoing quality improvement monitoring is necessary. (Buckwalter et al., 2017). This can be possible by eliciting assistance from the delirium QI team and nursing managers. One possible method for ongoing monitoring of delirium outcomes is through yearly delirium updates and assessments through the hospital's staff online education program, Catalyst.

Disseminate the Knowledge

Once the data was synthesized, a summary was developed to present the outcomes information to nursing staff, administration, and nursing leadership. This included recommendations for proceeding with further delirium education interventions in the future. Knowing that bedside nursing staff may question these non-pharmacologic interventions, communication and a sense of nurse-ownership is key to elicit "buy-in" regarding further education and change (Melnyk & Fineout-Overholt, 2019). The neurology team as well as neuroscience clinical nurse specialist were intermittently available on the postop nursing units to mentor staff.

Proposed Methodology

Design

The design chosen for this study was a non-randomized, pretest, posttest design. This design study made sense for this research as the desire was to see the effect of the intervention on the outcome (Terry, 2018). The teaching intervention was Power Point based and developed by this investigator (Appendix E). Data for the intervention included prevention measures from the Hospital Elder Life Program (Inouye et al., 1999), the THINKDELIRIUM project (ThinkDelirium, 2016), as well as teaching points from the delirium tool. The delirium teaching intervention occurred during the unit's

monthly staff meeting. Bedside nursing staff were given the option to participate in the pretest/posttest portion of the intervention and signed consent was obtained. The 30-minute-long delirium teaching intervention was then administered. Following the intervention, the posttest was administered. The two sets of test scores (pre and post education intervention) were entered into an Excel spreadsheet with the corresponding demographic data for each participant. Participants were identified by test ID numbers (pre-populated on the test forms and distributed in packet form). A subset of the data entry was verified by a third party (neurology nurse practitioner colleague) for accuracy.

Subjects and Setting

This study was set within two postoperative, mixed general/progressive care units (GC/PCU) in a large, 640 bed, multi-campus, tertiary hospital system. Participants included the nurse managers and director for the postoperative care units. After email and in-person meetings, two of the nurse managers agreed to a presentation on delirium signs and symptoms during their monthly unit meetings. It was estimated that there would be approximately seventy staff participants. At the beginning of the meeting, the study aims were discussed with the option to participate in a pretest and posttest after the teaching intervention. Signed consent (Appendix F) was obtained. Inclusion criteria were nursing bedside staff for the postoperative care units (this included registered nurses/managers, licensed practical nurses, and nurse technicians). This was later expanded to nursing bedside staff for a step-down cardiac unit. Exclusion criteria are non-bedside staff for the unit, administrators, and critical care nursing staff. Nurse managers for this facility participate in bedside care and thus included. Participants were identified by test ID numbers (pre-populated on the test forms and distributed in packet form). A portion of data entries was verified by a third party (neurology nurse practitioner colleague).

The proposed sample for this study was based on a statistical power analysis performed for sample size estimation. For the primary quality improvement aim of this study (to increase nursing

knowledge regarding the identification of post-op delirium within-person changes), using two tails and an effect size of 0.5 (moderate), and alpha of 0.05, and a power of 0.8 resulted in a total sample size needed of 34 subjects for a fully powered study (Faul et al., 2007). It was anticipated that there would be enough bedside nursing staff for a fully powered study.

Demographics

Demographics that were collected at the start of the pretest included the nursing unit worked on, job position/title, years as a healthcare professional in that role, and years of education.

Tools and Measures

Two different delirium knowledge tests were identified during the review of the literature. Only one had a validity and reliability study performed on the test. This test was developed by Birge, Aydin, and Salman in 2020. The delirium tool is called the "Delirium Knowledge Test for the Intensive Care Nurse." This test is relatively quick to take and easy to administer: It is a 26-item true/false test. The test answers include an option for “I don’t know” as a response. There are seven false items and 19 true items. The test has been assessed for validity and reliability. A Cronbach's alpha coefficient was 0.83 which demonstrates good internal consistency. The test was determined to be of moderate difficulty (Birge et al., 2020). The test results are easily tabulated since it is true/false. There were no delirium knowledge tests found in the literature for non-ICU nurses that had been tested for validity and reliability. Please see Appendix D for the questionnaire/demographic forms and answer key.

Data Collection

Nursing bedside staff were given the option to participate in the study during their monthly staff meeting. Informed signed consent (Appendix E) was obtained which included potential risks of loss of time, and loss of privacy regarding personal demographic information and test score results. Possible benefits included improved knowledge of delirium and increased ability to care for delirium patients.

Participating nurses were administered the nursing delirium knowledge questionnaire (Birge et al., 2020) along with a section on standard demographic data. The tests had identification numbers attached to allow for participant privacy, blinding for the investigator, and paired t-tests during statistical analyses. Following the baseline test, didactic content was presented on delirium; specifically monitoring for signs and symptoms of delirium and early, nursing, nonpharmacologic, bedside interventions. The discussion covered the questions within the pretest/posttest and relied on research-proven modalities described by Inouye et al.'s Hospital Elder Life Program (1999). Based on findings from the literature review, multimodal methods are the most effective for improving nursing delirium knowledge. Therefore, the nurse audience was engaged in discussion and queried regarding case studies. Immediately following the initial education intervention, the posttest was administered with the nurse manager facilitating.

Analysis

Missing data was evaluated. For summated scales on which fewer than 20% of an individual's responses are missing, the individual's mean on the remaining items were substituted, as appropriate. Scoring algorithms for the Delirium Knowledge Test for the Intensive Care Nurse instrument were conducted per the published use manual. Test answer options were true/false and "I don't know" for the 26-item test. For the purposes of statistical analysis, incorrect answers were grouped with "I don't know." Each statistical test was conducted at p=.05 level. Data was analyzed using descriptives (means, medians, standard deviations of scores), Pearson's correlations, and independent and paired t-tests. Pre- and post-scores were compared within the nurses with a paired t-test. A change score was calculated from pre to post. Independent t-test and Pearson's correlations were used to assess relationships between change scores, demographic variables, and outcomes, as appropriate.

Findings

There was a total of 25 participants in two different education sessions. There were no test results that had greater than 20% responses missing. The mean pretest score was 72.15% answers correct with a standard deviation of 15.59 and a standard error mean of 3.12. The mean posttest scores for the cohort were 93.38% with a standard deviation of 6.71 and standard error mean of 1.34. Pre- and post-scores were compared within the nurses with a paired t-test. Computed *t*-statistic was -7.352 for a *p* value of <.001, *d*=1.47. This demonstrates a large statistical significance and clinical difference from pre to posttest scores. A change score was calculated from pre to posttest of 21.23%. Independent t-test and Pearson's correlations were used to assess relationships between change scores, demographic variables, and outcomes. There was no difference in knowledge gained by educational preparation: $F(13,11) = 0.46$, $p=.91$, $n2 =.35$. Lastly, there was no difference in knowledge gained by years in the role: $r =.77$ (CI -.47, .34), $p =.72$. See Appendix G for statistical tables.

Discussion

There was a statistically significant improvement in test scores for all bedside nursing groups from the pretest to the posttest (greater than 20% improvement). This indicates that use of an education intervention on delirium prevention increased bedside nursing staff's knowledge, as measured immediately after the education. There was no difference in knowledge gained between the pre and posttest scores by years in the role. However, the study was underpowered. For full power, at least 34 participants were required and the study had 25 participants. However, the primary findings of greater than 20% improvement in pre and posttest scores, along with a large clinical effect size of 1.47 give evidence that the intervention was effective in increasing knowledge.

The findings of this pilot study are similar to findings from the limited studies identified in the literature review on nursing education interventions on nursing knowledge. Vande Steeg's three-month course on delirium for medical surgical nurses showed a statistically significant improvement in test

score of 8.9%. But this was not as high as the improvement seen in delirium knowledge for this study. Improvement based on nurse experience was not included in the analysis by Vande Steeg. In the second study focused on for this literature review, Birge and Aydin noted that identification of delirium increased slightly after two 40-minute learning sessions for ICU nurses, but the increase was not statistically significant, whereas it was significant for this pilot study. Again, nurse's experience was not taken into account. The last study in the literature review that looked at a one-hour delirium education intervention found a significant improvement in delirium test scores before and after the teaching. However, no statistically significant improvement in staff recognition of delirium in the posttest phase. Data was collected on staff experience, but not analyzed (Wand et al., 2014). This is an important point: staff knowledge may increase, but that may not apply to real-life situations. Correct identification of early delirium symptoms allows nursing staff to intervene. This pilot study looked at nursing knowledge based on pretest/posttest scores alone and not day-to-day application.

Conclusion

In summary, the findings of this pretest-posttest pilot study show that use of an education intervention on delirium prevention increased bedside nursing staff's knowledge, as measured immediately after the education. There was no difference in knowledge gained between the pre and posttest scores by years in specific nursing roles. The findings of this pilot study are similar to findings from the limited studies identified in the literature review showing an increase in nursing knowledge after an education intervention.

Implications

The pilot study demonstrated that a learning session on delirium was effective in improving nursing knowledge. The medical facility in which the study was conducted has been growing by leaps and bounds. Over the past two to three years the medical system has expanded into the rural market.

There are now two critical access hospitals and two regional hospitals that are a part of the main medical center's two city campuses. A new cancer center has also been built. The delirium education intervention could be implemented at these additional sites in order to decrease delirium incidence and thus improve patient outcomes. The education focused on nursing, bedside, nonpharmacologic interventions to prevent delirium as well as identify it early. The system-wide implications of decreased delirium incidence could be large in terms of improvement in patient length of stay, avoiding untoward outcomes, and in cost-savings. One method to potentially disseminate the education could be through the hospital's learning system, Catalyst. Catalyst allows for interactive education modules to be accessed by all nursing staff. The use of an e-learning module was used successfully in the Vande Steeg research study (2014).

The delirium knowledge questionnaire includes questions about utilization of a delirium monitoring tool—specifically that delirium monitoring tools are an effective way to catch delirium early—this was also demonstrated in the van de Steeg study. There is no delirium monitoring tool utilized at this facility on the non-critical care units. This is something that could be considered for the future.

Lastly, this pilot study could be considered the starting point for additional research studies on delirium incidence within the medical center. The study could be repeated with a goal of a fully powered study and include patient chart reviews before and after the intervention. This would allow the investigators to see if there is a difference in patient delirium-related outcomes (such as falls, length of stay, post-acute care placement, etc.) with an improvement in nursing delirium knowledge.

Study Limitations

There were several limitations to this pilot study. There was difficulty in doing in-person learning in order to administer a paper and pencil pre/posttest. Since the Covid-19 pandemic, meetings have

transitioned to encompass online formats such as ZOOM or Microsoft Teams, or even adjusted to an email format. This was one of the obstacles faced for this pilot study. There were multiple nurse managers willing to have their staff participate, but very few in-person meetings occurring at the medical center. The few in-person meetings were generally offered as a hybrid meeting option to be in person or online via ZOOM. With only portions of nursing staff attending meetings in person, there were fewer participants. This ultimately resulted in an under-powered study. The focus of the study was intended to be on postop nurse's knowledge. Due to the lack of in-person participants, this was expanded to bedside nursing staff on both a general post-op and a cardiac step-down unit.

Additional limitations include the lack of a delirium tool for non-ICU nurses which may have impacted results. Lastly, as part of a DNP program of study, with only one researcher, there were limitations of minimal personnel, few financial resources, and time.

Recommendations

Delirium has the potential to impact every single hospitalized patient with possible far-reaching negative implications, unless it can be addressed early. In a 640-bed tertiary care hospital in the Midwest, delirium in elderly, postoperative patients was identified to be a major problem. Delirium is related to poor patient outcomes, an increase in specialty consultations, and rising costs. For these reasons, the idea of nursing education to improve delirium knowledge was developed. By initiating an education program for delirium prevention and early treatment, patient outcomes have the potential to improve, workload burden on the inpatient neurology team could lessen, and the hospital could benefit by way of decreased costs and improved reportable metrics. Expanding on this education through use of a yearly computer module for staff will maintain nurses' knowledge in the future. This hospital system also includes multiple critical access hospitals: The education program could be extended to the rural facilities to improve their patient outcomes. Areas for future research includes a second pilot study,

looking at delirium incidence via the EHR before and after the education intervention. A second area for study could incorporate the use of a nursing simulation lab (readily available through the hospital's associated college) to help with the education intervention. Utilizing additional resources such as involvement of members of the delirium QI team with financial backing of the medical center would also allow for a more expansive study. Lastly, including a delirium documentation tool to guide the assessment and recording of delirium in non-critical care patients would improve delirium care.

Future considerations to address the obstacle of fewer in-person meetings includes utilizing an electronic version of the test (such as live quiz app Kahoot!) that has the ability to record answers versus an email version of the pre and posttest.

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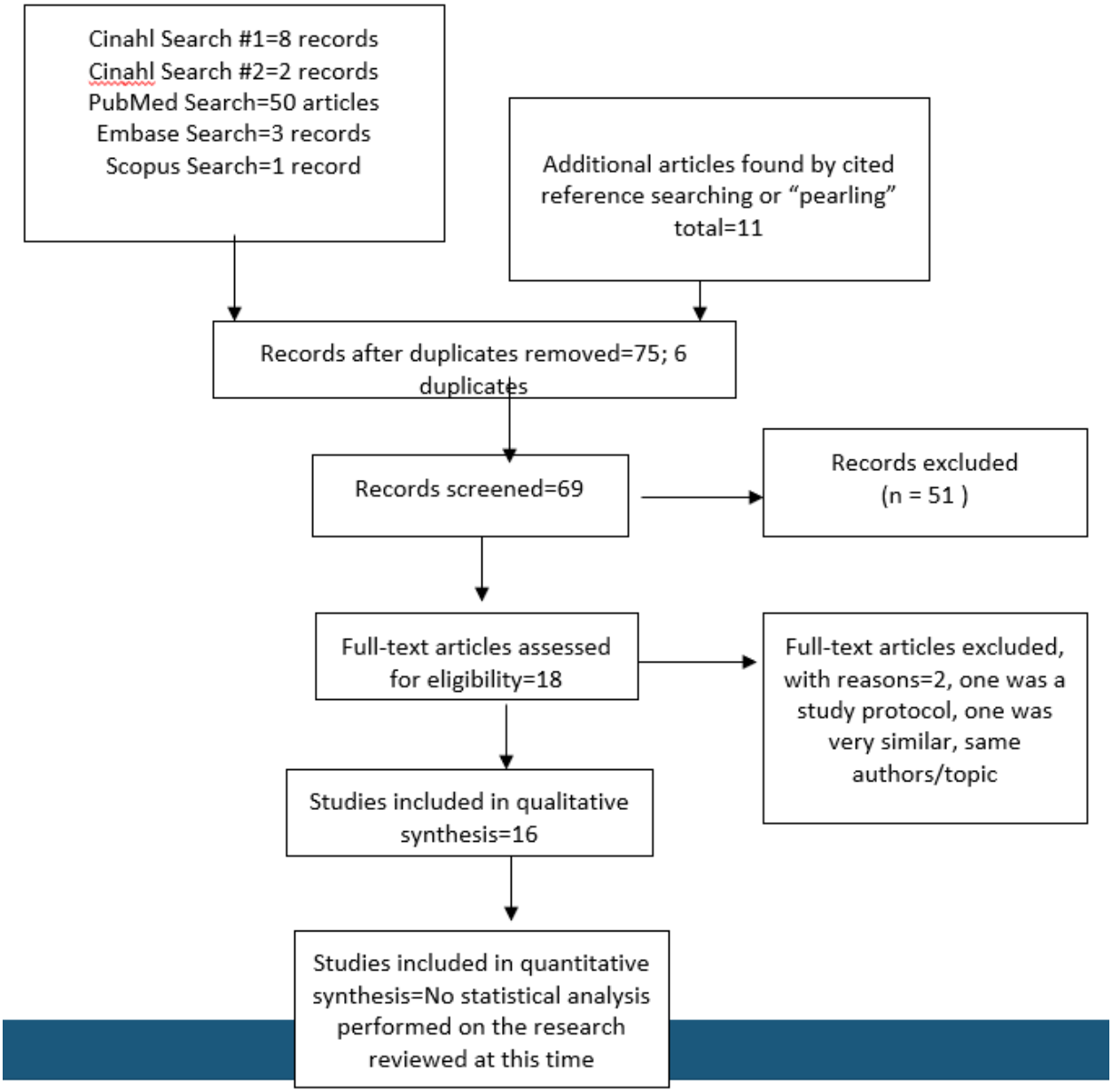
Appendices

Appendix A: Process for Literature Review



Appendix B

Appendix A: Final Evidence Table: Preventing Delirium in Hospitalized Elderly Patients

Sarah Eckles-Van Horn

Picot Question: For post-op elderly adults, does the use of a teaching intervention for bedside nurses regarding identifying and preventing delirium reduce the risk of delirium as compared to no nursing intervention?

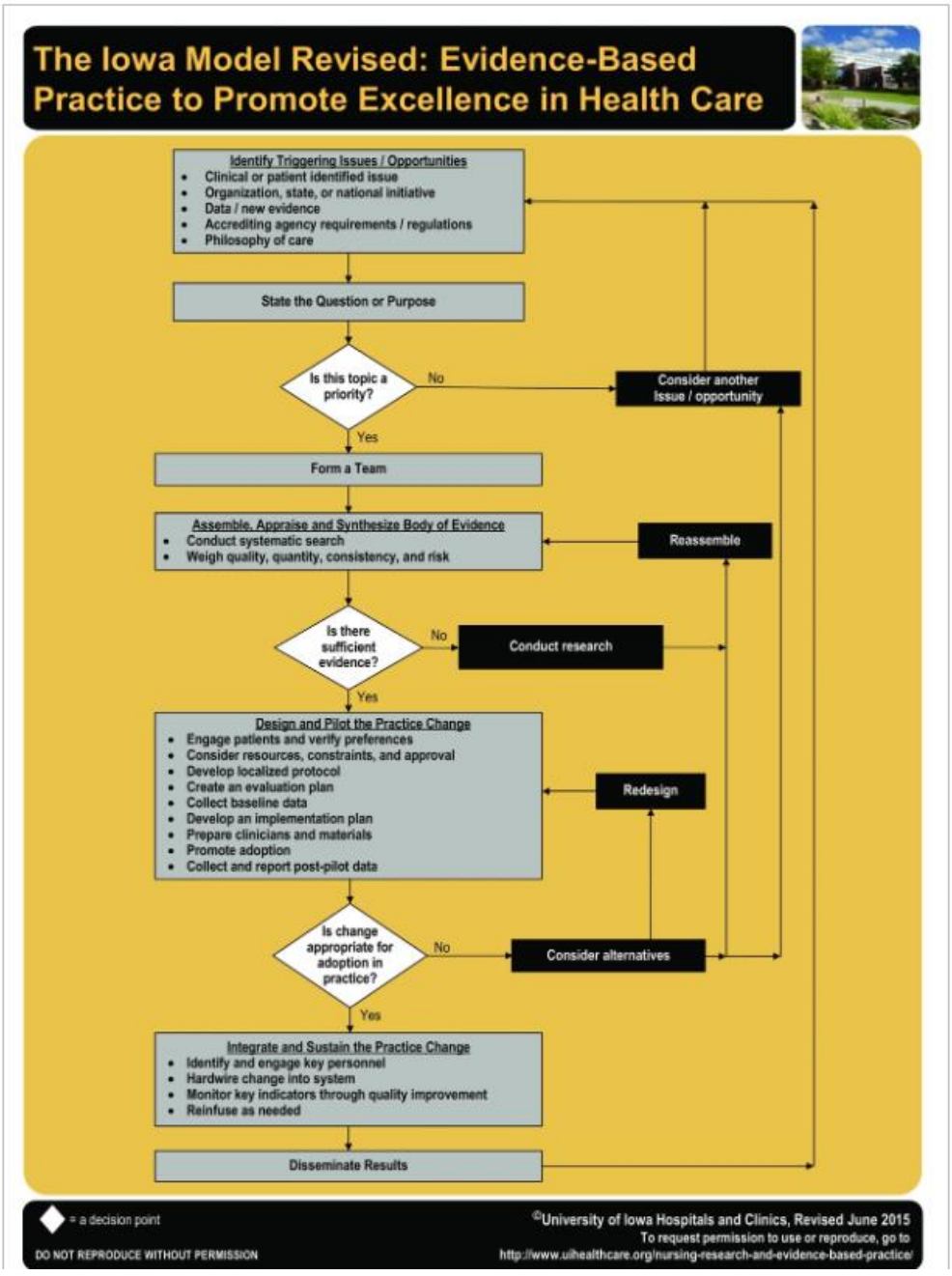
	Citation	Purpose/ Hypothesis/ Research Question	Population/ Setting	Design/ Method	Sample	Measures	Findings/ Outcomes	Notes by Reviewers (limitations/ lessons)	Level/ Quality of Evidence
1	**Birge, A.O., & Aydin, H.T. (2017). The effect of nonpharmacological training on delirium identification and intervention strategies of intensive care nurses.** ***Intensive and Critical Care Nursing 41,*** **33-42.**	Aim is to "investigate the effects of nonpharmacologic interventional training on delirium recognition and intervention strategies in ICU nurses" (Birge & Aydin, 2017).	Medical ICU RN's, consecutive ICU pt's who met study criteria admitted within a certain timeframe (12/1/2021-4/13/2014 + 8/1/2014-11/30-2014) at a university hospital in Turkey	Quasi-experimental study using a pretest-posttest design, nonrandomized. **Two-40 min education sessions** were given to nursing regarding delirium information then specific delirium prevention interventions. The ICU pts were eval'd for delirium before and after the intervention. The nurses were evaluated on their knowledge by way of observation by a trained observer before and after the intervention x 30 min	23 nurses and 135 patients.	Patient Introduction Form, Confusion Assessment Method for the ICU (CAM-ICU), Delirium Risk Factors Form, Nurse Introduction Form, Non-pharmacological Interventions in Delirium Prevention Form.	Delirium was id'd in 26.5% of pts pre-test and 20.9% (p=0.627). Incidence of hypoactive delirium >hyperactive delirium. Breakdown given of characteristics of delirious pts. Agreement of delirium recognition low pretest and increased posttest, but not statistically significant. Use of non-pharm interventions increased by RNs posttest.	Agree with researchers; **2 educational sessions may not have been sufficient** and may explain why the id of delirium did not change (statistically) significantly.**This study was performed in the ICU where hypoactive delirium is most often the type of delirium seen; would be a gap and an opportunity for research to trial this on a med-surge nursing unit.**	Level=IV (pretest posttest without control). Quality= Moderate
2	Brooks, P., Spillane, J.J., Dick, K., & Stuart-Shor, E. (2014). Developing a strategy to identify and treat older patients with postoperative delirium.*AORN Journal 99(2)*, 256-271.	"To test a postoperative delirium identification program in which personnel used screening tools to identify patients 65 years of age or older admitted for elective surgery."	All pts 65 + scheduled for elective surgery at a local 259 bed community hospital under the care of one general surgeon	Quality improvement study using descriptive stats to describe measures of central tendency (mean/median /mode), measures of variability. All scheduled pts had Mini-cog, followed by RASS or CAM ever shift. If +, then post-op delirium assessment and MD order sheet initiated. No inferential stats used. Prior to the study, rate of delirium on the ward was determined by a chart review of 106 pts for comparison.	96 pts over 65 who were scheduled for elective surgery (w/ one general surgeon).	Mini-cog, CAM, CAM-ICU, RASS (Richmond Agitation and Sedation Scale)	13% prevalence of post-op delirium higher than previously id'd (8%). RN compliance w/ CAM/CAMICU and RASS was 91%. Low incidence of pts with delirium who had pre-op positive Mini-cog tests. 21% of Mini cog tests not done by RNs. There was a higher mortality rate in the postop delirium group. There was a higher rate of pre-op dementia and etoh abuse in the postop delirium group.	Researchers pointed out that it would have been useful to have RN input after the study-- agree. Compliance with preop Mini-cog not great.Only elective OR pts studied, expect that delirium incidence and sequelae would have been increased if emergent operative pts had been added to the study.	Level=IV (case control). Quality= Moderate
3	Burton, J.K., Craig, L.E., Qi Yong, S., Siddiqi, N., Teale, E.A. Woodhouse, R., Barugh, A.J., Shepherd, A.M., Brunton, A., Freeman, S.C., Sutton, A.J., & Quinn, T.J. (2021). Non-pharmacological interventions fo preventing delirium in hospitalized non-ICU patients. *Cochran Review*. https://doi.org/10.1002/14651858.CD013307.pub2	Systematic review of the literature up to 9/2020 of RCTs evaluating non-pharmacological interventions intended to prevent delirium in non-ICU patients	Adult, hospitalized, non-ICU pts. Not specific regarding op vs non-op or elderly.	SR of RCTs up to 9/2020. RCTs were studying a non-pharm intervention (s) for prevention of delirium.	22 studies with 5718 participants id'd	Multiple different assessment tools utilized.	Using stats, researchers found 3 main non-pharm interventions prevented delirium: Re-orientation, stimulating memory, improving sleep hygiene. Authors report on multi-modal approach as more effective for reducing delirium.	Lack of evidence for other non-pharm interventions. Some studies did not have the researchers blinded to the subject's group. **Very helpful review of the research on a huge number of non-ICU pts when added together, but not specific to the elderly. No specific eval of nursing education as part of an intervention.**	Level=1, Quality high
4	Chong, M.S., Chan, M.P., Tay, L., & Ding, Y.Y. (2014). Outcomes of an innovative model of acute delirium care: The geriatric monitoring unit. *Clinical Interventions in Aging 2014:9*, 603-612.	To evaluate if the Geriatric Monitoring Unit improved outcomes in hospitalized (non-critical) delirious pts. GMU incorporates core interventions from HELP (Hospital Elder Life Program) (Chong et al., 2014). **(A follow up study to the discarded protocol article).**	Pts >65 yrs, dx of delirium by way of CAM, admitted to geriatric medicine department. Randomized to GMU vs standard care. GMU is a 5-bed ward in a hospital in Singapore.	Randomized, controlled trial. Prior to initiating the trial, a group of pt's receiving usual care were studied for outcome. Pt's admitted to gen med over approx 2 yrs were randomized (Zelen's) to GMU or standard of care. Multiple outcomes reviewed.	234 intervention patients and 39 corresponding pts in usual care or control group; final count for stats included an additional 47 pre-GMU patients also used for comparison.	Clinical characteristics, cognitive status (CAM +DRS delirium severity scores), Modified Barthel Index (MBI)--measure of physical disability, chemical restraint use, and pt complication rate + dc destination. Family satisfaction by phone interview 6 and 12 months.	Multiple outcomes evaluated had statistically significant improvement with use of GMU: Delirium total days, LOS, MBI improvement, physical restraint use, chemical restraint use, pressure ulcer rate, nosocomial infection rate	There were no initial statistically significant differences in mortality rate and dc destination between the control and GMU intervention group, however, later the researchers describe at 12 mo follow up a lower mortality rate for GMU group as compared to previous studies. Caregiver satisfaction in the GMU was obtained by phone interview, but there was no comparison to the control group's satisfaction with care-which would have been interesting. Interesting that they included dementia pts, excluded tele pts. Lastly, this is a major undertaking requiring change at many levels, involving change starting at administrative level.	Level=II Quality=High
5	Chuan, A., Zhao., L., Tillekeratne, N., Alani, S., Middleton, P.M., Harris, I.A., McEvoy, L., & Chroinin, D.Ni. (2020). The effect of a multidisciplinary care bundle on the incidence of delirium after hip fracture surgery: A quality improvement study. *Anaesthesia 75*, 63-71.	"...to introduce a care bundle intervention...to reduce the risk of delirium after hip fxr surgery."	Pts >50yrs of age admitted to Liverpool Hospital in Sydney, Australia admitted for emergency surgical tx of hip fxr	Non-randomized controlled trial:On admit, pts were eval'd for baseline characteristics and risk stratefied to determine delirium risk using various tools. Tx group got the delirium care bundle. Part of bundle; skr parts to the bundle, last was**fort-nightly staff education** . Delirium incidence was compared bw control and study group.	150 consecutive pts before (no care bundle/standard care)in the historical control and 150 consecutive pts after (care bundle group)	4 characteristics initially: abbreviated mental test, Apache-2, Charlson comorbidity index, and GFR. Points then applied.3-D CAM initially and at day 3.	33% reduction in delirium on 3rd post-op day as compared to control group	Multiple other studies have had similar results, but they all are using slightly different interventions. Is the education component one of the unifying factors???? **This article mentions a different method of teaching about delirium "train the trainer."**	Evidence Level=III. Quality moderate.
6	Durst, J., & Wilson, D. (2020). Effects of a protocol on prevention of delirium in hospitalized hip fracture patients: A quality improvement project. *International Journal of Orthopaedic and Trauma Nursing, 36* , 1-4.	PICO question framed by researchers: "In adult pts hospitalized with a hip fracture, does the use of a hip fracture protocol containing delirium prevention interventions decrease the incidence of delirium?"	A convenience sample utilized of 90 adult hospitalized pts caused by GLF, age 65+, LOS >3days, on an orthopaedic unit at a 413-bed hospital in Illinois.	Prospective, quality improvement project. **Nursing staff were given education (unspecified)**, chart audits done before the protocol and teaching and then audits performed after. If pt scored CAM +, protocol was to be initiated by provider	Convenience sample of 90 pts, 45 pt's pre implementaion of a hip fxr protocol + RN education and 45 pt's post-implementation (by chart audit).	CAM (short version) was used to assess delirium for all pts each shift. CHART-DEL (Chart Abstraction for Delirium During Hospitalization instrument) was used for chart audits throughout hospitalization until dc along with CAM.	Post-implementation, hip fracture protocol with delirium component only used 31% of the time. Delirium prevention measures documented by nurses on 75% of pt's post-intervention (not documented at all pre-intervention). No significant change in incidence of delirium before and after the interventions.	Interestingly, the researcher did not speak to the dramatic change in delirium prevention documentation from none to 75% by nurses. Poor engagement amongst ortho surgeons listed as a reason for minimal use of the hip/delirium order set. A real time audit mentioned as one way to help--question if more provide education would help, include advanced practitioners?	Level= Quality=Low quality, further research will very likely have an impact on our confidence in the estimate of effect

7	Inouye, S.K., Bogardus, S.T., Charpentier, P.A., Leo-Summers, L., Acampora, D., Holford, T.R., & Cooney, L.M. (1999). A multicomponent intervention to prevent dementia in hospitalized older patients. *New England Journal of Medicine, 340 (9)* , 669-676.	"...trial of a multcomponent strategy (Hospital Elder Life Program/HELP) to reduce the number of risk factors for delirium with the goal of preventing delirium in hospitalized older pts."	Consecutive pts admitted to the gen-med svc, over 70, no admit delirium, and at intermediate to high risk for delirium. All subjects were matched to a similar non-intervention pt for comparison using a computer algorithm.	Controlled clinical trial using prospective, individual matching for comparison (non-randomized, convenience/ consecutively admitted pts). Non-intervention matches rec'd usual care. Intervention group had HELP strategy used which focuses on 6 interventions (cognitive impairment, sleep deprivation, immobility, visual impairment, hearing loss, dehydration).	2434 eligible, 1265 excluded, final sample 852.	MMSE, Digit span test of inattention, CAM, Katz's activities of daily living, Jaeger test for vision, chart review to calculate APACHE II.	Sig number of pts has MMSE<20 on admit (mod dementia). P value was sign at 0.02 for the difference in delirium in the intervention vs the matched control group rec'ing standard care. Total number of days of delirium was less in the intervention group. Episodes of delirium were also less.	Contamination occurred with the non-intervention group of pts as hospital staff took care of both groups.	Level III+. Quality is moderate to high due to sample size and method of matching subjects bw control and study groups.
8	Layne, T., Haas, S.A., Davidson, J.E., & Klopp, A. (2015). Postoperative delirium prevention in the older adult: An evidence-based process improvement project. *Medsurg Nursing, 24 (4),* 256-263.	Goals were to "id pts at risk for developing delirium and prevent it's onset, id pts at earlier stages of delirium, and implement an evidence based delirium prevention protocol."	At a 40 bed med-surge unit at a 140 bed tertiary care hospital in Southern CA.	**1st- education sessions for nursing staff completed**. All pt's in the sample screened for risk factors of delirium using 3 areas (age, hx dementia, 48 hrs post-op) + CAM. Depending on results, 3 levels of interventions were initiated along w/pt teaching.	Purposive sampling by obtaining daily surgical schedules of pt's that met criteria. Sample=52 pts.	Geriatric Nursing Education Consortium for education on delirium. CAM	CAM was completed 81 % of charts reviewed post-interventions. CAM was observed by trained observers for 20 assessments. 90% of those were documented correctly, but only 20% of the time were all parts of the interventions performed. Delirium rate described as 13%	Unclear if the surgery schedule included emergency surgeries or scheduled surgeries--this could make a sig difference in delirium rates. The screening for risk of delirium on admit could be sig more robust: Risk factors id'd by age>65, hx dementia, 48 hrs post-op. No comparisons were able to be made, did not look at any historic similar pts for controls, etc.	Evidence Level =VI, single qualitative study. Quality is low.
9	Li, X., Wang, Y., Liu, J., Xiong, Y., Chen, S., Han, J., Xie, W., & Wu, Q. (2021). Effects of perioperative interventions for preventing postoperative delirium: A protocol for systematic review and meta-analysis of randomized controlled trials. *Medicine (Baltimore),100(29)* , 1-8. doi: 10.1097/MD.0000000000026662. PMID: 34398027; PMCID: PMC8294881.	"Meta-analysis to review and evaluate published RCTs that compared the efficacy of different interventions for preventing postoperative delirium in adults, and determine whether these interventions improvedthe clinical outcomes..."	Perioperative, hospitalized, adult pts over age 18, evaluated by validated screening tools.	Meta-analysis performed of RCTS that fit inclusion criteria	63 RCTs chosen based on inclusion/exclusion criteria. A total number of participants was not reported, but each study cited had number of participants described.	Multiple tools utilized by the various studies. Appears most often, this was CAM, CAM-ICU, DSM guidelines for dx of delirium.	Primary outcome for POD incidence looked at multiple factors including pharmacologics. Multicomponent interventions that included cog training, **multimedia education** (6 RCTs w/895 pts) showed sig less POD.	Very up-to-date information on best EBP for prevention and tx of delirium from a large number of RCTs. Authors note that there was limited data for most interventions, many of the studies had "significant heterogeneity," w/many different types of surgeries, also 11 of the 63 studies had small sample sizes of <110 subjects. Authors note that successful prevention strategies include multifactor methods to reduce risk factors w/nonpharm interventions as the mainstay."	Evidence Level=I, high quality.
10	Lundstrom, M., Edlund, A., Karlsson, S. Brannstrom, B., Lundstrom, G., & Gustafson, Y. (2005). A multifactorial intervention program reduces the duration of delirium, length of hospitalization, and mortality in delirious patients. Journal of American Geriatrics Society, 53, 622-628.	To investigate if an educational program combined with reorganization of nursing/medical care would improve outcomes for older delirious pts.	General medical pts over age 70 admitted to 2 wards: The dept of general internal medicine at Sundsvall Hospital, Sweden.	RCT. Pt's were randomized to the routine care/control ward or the intervention ward. The interventions consisted of a **2 day course for staff to focus on assessment and prevention of delirium**. Education was also given to caregivers regarding delirium and dementia, care was reorganzied, and there was monthly guidance given to nrsg staff during the 8 mo study.	400 general medical pts	OBS Scale was used along with the MMSE. KATZ ADL Index also used. Baseline vision and hearing testing also.	No difference in delirium prevalence w/in the 1st 24 hrs bw the 2 groups. By day #3, there were fewer delirious pts on the intervention ward, but not statistically significant. By day #7, there were fewer pts on the intervention ward and this was stat sig. Mean LOS on the intervention ward was stat sig less than the control ward. No difference in HHC needs on dc bw the two groups. Delirous pts on the intervention ward had sig lower mortality than delirous pts on the control ward.	The OBS Scale is reported to match the CAM as far as id'ing delirium. This study included all gen med pts, not just post-op pts, which makes it a bit different. It included demented and post-stroke pts. It is better powered that some of the other studies and is a RCT. However, it's not clear how the MMSE is used. Historically, it's used to gauge cognitive impairment, not the inattention and waxing/waning of delirium. Researchers discuss diagnosing dementia, but unclear if they were using MMSE to verify or diagnose. Dementia is not a diagnosis made inpt as delirium potentially muddies the overall clinical picture. Unclear why OBS Scale alone was not used, as goal was to id delirium, not dementia.	Level II, high quality research
11	Lundstrom, M., Edlund, A., Lundstrom, G., & Gustafson, Y. (1999). Reorganization of nursing and medical care to reduce the incidence of postoperative delirium and improve rehabilitation outcome in elderly patients treated for femoral neck fractures. Scandinavian Journal of Caring Science, 13(3), 193-200.	"...To investigate whether a reorganized programme of nursing and medical care, combining the core elements of the two earlier intervention studies, could reduce the incidence of postoperative delirium and improve functional outcome in pts treated for femoral neck fxrs. " Built on 2 previous studies, 1 looking at nursing interventions against delirium and 2nd looking at limiting postop complications including use of O2.	Consecutive, elderly, hip fxr pts admitted to the Dept of Rehab Pitea River Valley Hospital, Umea, Sweden.	Non-randomized controlled trial, comparing an intervention group of 49 pts in Sweden to two studies in Sweden and two in the US. **Staff rec'd 2 weeks training, included sessions about delirium, risk factors, prevention, and tx.** This was prior to the study.	49 consecutive pts as compared to control grou pts in 4 other studies	All 49 pts were intervened on. Tested day 1 and 7 using the OBSS and DSM-III-R. Delirium in 1st 8 hrs tx'd as emergence delirium. 6 month f/u done to eval walking ability, living situation.	Results are complex as there are 4 studies used as historical controls; delirium difference not statistically sig, although the rate of some complications are statistically sig less, such as decub ulcers.	This study is dated (1998) and the historical controls that were attempted to use had limitations as some of the studies were some yrs earlier. The control groups were also double in size from the intervention group. A lot has changed in delirium care since this study (for example, LOS of stay on ave is 12.5 +/- 8.4 days). **Included this study due to length of staff training regarding delirium care. Focus during stay of avoiding hypoxia, tx'ding pain, ortho unit set up like a home-type environment. Hard to do this in current healthcare settings.**	Evidence is IV, quality is mod to low. Felt like comparing apples and oranges. Need to do more research.

12	Lundström, M., Olofsson, B., Stenvall, M., Karlsson, S., Nyberg, L., Englund, U., Borssén, B., Svensson, O., & Gustafson, Y. (2007). Postoperative delirium in old patients with femoral neck fracture: a randomized intervention study. Aging Clinical Experimental Reseach, 19(3):178-86. doi: 10.1007/BF03324687. PMID: 17607084.	"Whether a postoperative multifactorial intervention program can reduce delirium and improve outcomes in patients with femoral neck fractures."	Consecutive elderly post-op pts (femoral neck fxr) admitted to the ortho dept at a large University hospital in Umea, Sweden from 5/2020 thru 12/2020	RCT. 102 of pts were in the intervention group which was a 24 bed geriatric specialty unit with a team approach including geri assessments, mgmnt, rehab. Staffing was 1.07 to 1! There were 15 components to the intervention including extensive staff education. **Staff education included a 4-day course on prevention and tx of post-op complications including delirium.**	Pt's >70 yrs old, consecutively admitted. 199 pt's randomized: 102 in intervention group and 97 in control/standard care group	Pre-op and post-op daily pt's were assessed for sx's of delirium. Measures incuded Organic Brain Syndrome Scale, Geriatric Depression Scale, and KATZ ADL index.	Pts in the intervention group had statistically sig (P=0.009) less delirium days than the control pts and there was less occurance of delirium in the intervention vs controls (P=0.003). This trend cont'd after the 7th postop day through dismissal; 20 in control were delirious at dismissal and none in the intervention group. Intervention pt's had fewer complications and shorter LOS.	There are a few issues with feasibility of applying this study in the "real world." Very rarely will there be a 1:1 ration of nursing to pt staffing, let alone almost 2:1 that was utilized in this study. The cost and resources are not available for that. The intervention was very in depth with 15 components--this is A LOT. All of the components are important, but it would be difficult to focus on all these at one time. This study was performed over two years to obtain the sample size they had (which was not terribly robust). Lastly, delirium within the first 8 hrs of OR was not counted, although they did not specifically refer to the as "emergence delirium" as other researchers have in the literature. This study included dementia pts, whilst many delirium studies do not, which may have also impacted results.	Level=II. Grade is high quality
13	Reppas-Rindlisbacher, C., Siddhpuria, S., Wong, E. K., Lee, J. Y., Gabor, C., Curkovic, A., Khalili, Y., Mavrak, C., De Freitas, S., Eshak, K., & Patterson, C. (2021). Implementation of a multicomponent intervention sign to reduce delirium in orthopaedic inpatients (MIND-ORIENT): a quality improvement project. BMJ open quality, 10(1), e001186. https://doi.org/10.1136/bmjoq-2020-001186	Implementing a bedside sign to prompt nursing staff to use multicomponent EB delirium prevention strategies in order to reduce delirium occurrence.	An orthopedic ward of 35 beds at a tertiary care academic site in Ontario, Canada with a reported ave of 30% delirium pts on a given day. Pts were nonrandomized and selected based on if they were admitted to the specific room designated for the intervention. Compared to control rooms on same unit at same time.	Multi-component sign was designed by delirium team based on HELP, piloted in 4 rms. **10 min education session for nurses on completion of the sign/filling in pt pertinent blanks.** Remainder of the ortho ward served as the control.	474 pts admitted over a 10 mo time frame to the designated four intervention rooms on the ortho ward.	CAM	Completion of filling out the signs improved as the study progressed. CAM positive rates increased from baseline to the intervention timeframe. Delirium prevalence was not sig decreased for the pilot intervention pts as compared to the controls/remainder of the ward. However, staff engagement and completion increased and 70% of family members of intervention-pts felt that the sign was helpful to communication.	This was not a large cohort of pts and only completed over 10 months. Would be helpful if this could be done in a randomized fashion for a larger sample with more factors studied (such as LOS, complications, questionaire regarding nurse engagement along w/delirium prevalence). It's a good start. Also, only a 10 min teaching intervention done with nursing.	Level III, quality is moderate. More studies are needed with larger sample, more time to help with power.
14	Siddiqi N, Harrison JK, Clegg A, Teale EA, Young J, Taylor J, Simpkins SA. Interventions for preventing delirium in hospitalised non-ICU patients. Cochrane Database of Systematic Reviews 2016, Issue 3. Art. No.: CD005563. DOI: 10.1002/14651858.CD005563.pub3.	"To assess the effectiveness of interventions for preventing delirium in hospitalised non-intensive care unit patients."	Hospitalized, non-ICU pts.	39 trials found thru SR by 2 researchers through 12/2015.	39 trials involving 16,082 pts	Multiple different assessment tools utilized.	Strong evidence found that multi-component interventions decrease prevalence of delirium, but only mod quality evidence that the interventions decrease delirium severity. Mod quality evidence regarding this and depth of anesthesia. Poor quality evidence regarding pharm interventions.	There has been a more recent SR, see above by Burton et al. Not specific to elderly or post-op pts or an education intervention for nursing staff.	Level I, quality high, but new/updated SR now available.
15	**van de Steeg, L., IJkema, R., Langelaan, M., & Wagner, C. (2014). Can an e-learning course improve nursing care for older people at risk of delirium: a stepped wedge cluster randomised trial. *BMC Geriatrics, 14(69)*, 1-8. doi: 10.1186/1471-2318-14-69. PMID: 24884739; PMCID: PMC4046094.**	"To determine whether e-learning can be an effective means of improving implementation of a quality improvement project in delirium care." Primary aim was to improve early recognition of elderly pts at risk for delirium.	Pts and nursing staff involved from general and medical surgical wards at 18 Dutch hospitals of various sizes and locations.	**4-hr e-learning course for RNs at the various hospitals to be completed over a 3 mo timeline**. Monthly overview was also given to each ward. 2 wards at each hospital (medical & surgical) were chosen. The hospitals were randomized for which got the e-learning intervention. Charts of pts were reviewed before and after the interventions.	Records were reviewed from 3,273 pts. 1862 from control phase and 1411 from intervention phase. 1123 nurses invited to do e-learning. 913 nurses participated.	Delirium Observation Screening Scale (DOS), LOS, # nursing interventions performed for at risk pts as identified thru use of the screening instrument for the Frail Elderly Project, Groninger Frailty Indicator, or Identification of Seniors at Risk (ISAR). Percentage of nurses completing the course and changes in their knowledge also measured thru the e-learning course.	Following the e-learning intervention, nurses scored higher on testing regarding delirium knowledge. Delirium risk screening increased sig pre and post intervention. Goal of FEP was to screen all pts, which did not happen. Delirium diagnoses were recorded less % of time in the intervention phase than the control phase. The number of documented at risk pts was higher during the intervention than prior to. Nursing interventions for at risk pts increased in the intervention phase but not statistically significant.	This was a LARGE, stepped wedge RCT that focused solely on nursing education to prevent delirium! The only article found in the SR with nursing education as the main intervention. However, the authors extrapolate that since delirium screening increased, and delirium was reported less by nursing that there was less incidence of delirium. It is not clear what the quality control was for this. For example, as compared to delirium assessments by a nurse expert/researcher.	Level II, quality high
16	**Wand, A.P., Thoo, W., Sciuriaga, H., Ting, V., Baker, J., & Hunt, G.E. (2014). A multifaceted educational intervention to prevent delirium in older inpatients: a before and after study. *International Journal of Nursing Studies, 51(7)*, 974-982. doi: 10.1016/j.ijnurstu.2013.11.005. Epub 2013 Nov 25. PMID: 24332570.**	"…to evaluate whether a multifaceted educational program targeting the modifiable risk factors for delirium prevented the development of delirium in hospitalised older pts on a medical ward and improved staff confidence, knowledge, clinical practice following the intervention."	All pts >65 yrs admitted to a gen-med ward in Sydney, Australia in two separate groups	Quasi-experimental, nonrandomized pre/post test data on medical staff learning. **1 hr education session focusing on delirium prevention for staff including nursing.** Pt information gathered pre-intervention and post-intervention.	255 pts recruited, 126 pre and 129 post-intervention. 77 staff participated, 39 docs and 35 nurses.	Staff were given a 15-item questionnaire assessing knowledge + a subjective self-assessment (Likert scale) before the education and then 3 months later. Weekly tutorials. Written summary given to staff. Posters placed on ward. Chart reminders placedin pt records. Day 1 & 4 MMSE, RUDAS (Rowland Universal Dementia Assessment Scale), Blessed Dementia Scale, clock draw test, CAM, Barthel Activities of Daily Living Index. MMSE/RUDAS less than 26=cog impairment and BDS>4=dementia. CAM must be + w/a clinical interview=delirium.	Subjects for this study had all different diagnoses, not just fxrs; included resp, cardiac, GI , etc. There was stat sig improvement in Barthels ADL Index in post-intervention group. Delirium was higher in the pre-intervention as compared to the post-intervention group (P<0.042). No difference in LOS, complications, death, or dc to higher level of care. Staff scores on testing improved after the intervention but the recognition of delirium actually went down.	Despite staff scoring better on delirium id testing, in practice, staff correctly identified delirium LESS. Researchers note that they had a large cohort of non-English speaking pts which may have contributed to this(approx 30%). Delirium risk factors in the charting was low.	Level is a IV, quality is moderate

Guide to abbreviations: Id=Identify, RN=Registered Nurse, CAM=Confusional Assessment Method, dc=discharge, LOS=Length of Stay, ed=education, GLF=Ground level fall, GMU=Geriatric Monitoring Unit, ICU=Intensive Care Unit HELP=Hospital Elder Life Program. POD=Postop delirium. Pt's=patients.	

Appendix C: Theoretical Framework



Buckwalter et al. (2017).

Appendix D: Data Collection Tool Parts I & II, Answer Key: Delirium Knowledge Test for the ICU Nurse

Birge et al. (2020)

Test ID #:_____

Delirium Knowledge Test Part I

** This test is for research purposes only! Do your best effort and PLEASE attempt to circle an answer for EACH question, do not leave blanks. THANK YOU for your participation!!**

Demographic Data

Unit you work on (Circle): 2NW/NE 5S Float Pool/Other:_____

Job title:_____

Years as a health care professional *in this role*:_____

Years of education (Circle): High School Diploma/LPN Associate Degree
Bachelor's Degree Master's Degree Other:_____

1. Cognitive impairment reduces the risk of delirium. T/F/Don't know
2. Superficial sedation is a preventive approach in patients given mechanical ventilator support. T/F/Don't know
3. Delirium causes the patient to stay in the intensive care unit (ICU) for a longer period. T/F/Don't know
4. A habit of substance abuse, such as smoking and alcohol consumption, increases the risk of delirium incidence. T/F/Don't know
5. One of the most important factors causing delirium is an imbalance in the neurotransmitter levels (dopamine, gamma aminobutyric acid, serotonin). T/F/Don't know
6. Benzodiazepine/opioid medication therapy reduces the risk of delirium. T/F/Don't know
7. The longer the duration of mechanical ventilation is, the higher the risk of developing delirium becomes. T/F/Don't know
8. Non-pharmacologic approaches are not effective in the prevention of delirium. T/F/Don't know
9. Patients with limited mobility have a higher risk of developing delirium. T/F/Don't know
10. There is no relationship between delirium and changes in sensory status of the patient (hearing and vision problems). T/F/Don't know
11. As serum C-reactive protein (CRP) levels increase, the risk of delirium increases. T/F/Don't know
12. Delirium can easily be detected with a reliable measuring instrument. T/F/Don't know
13. Atypical antipsychotic treatment may reduce the duration of delirium. T/F/Don't know
14. Mixed-type delirium is a condition in which both hyperactive and hypoactive delirium symptoms occur during the day. T/F/Don't know
15. The delirium assessment should be regularly made at least once per shift. T/F/Don't know
16. Changes in blood pressure (hypo/hypertension) increase the risk of delirium. T/F/Don't know
17. Lethargy and dullness are symptoms specific to hypoactive delirium. T/F/Don't know
18. Using three or more drugs affects the risk of developing delirium. T/F/Don't know
19. Visits to patients who have developed delirium should be restricted. T/F/Don't know

20. Agitation is observed in all types of delirium. T/F/Don't know
21. Delirium assessment made by trained people takes a short time. T/F/Don't know
22. Early mobilization is important in the management of delirium. T/F/Don't know
23. Effective treatment of hypoactive delirium shortens the duration of the patient's need for a mechanical ventilator. T/F/Don't know
24. Delirium is not a factor that affects mortality in ICUs. T/F/Don't know
25. Delirium increases the cost of patient care. T/F/Don't know
26. Training and an interdisciplinary team approach are important in the effective management of delirium. T/F/Don't know

Test ID # Matched to First ID:_____

Delirium Knowledge Test Part II Birge et al. (2020)

** This test is for research purposes only! Do your best effort and PLEASE attempt to circle an answer for EACH question, do not leave blanks. THANK YOU for your participation!!**

1. Cognitive impairment reduces the risk of delirium. T/F/Don't know
2. Superficial sedation is a preventive approach in patients given mechanical ventilator support. T/F/Don't know
3. Delirium causes the patient to stay in the intensive care unit (ICU) for a longer period. T/F/Don't know
4. A habit of substance abuse, such as smoking and alcohol consumption, increases the risk of delirium incidence. T/F/Don't know
5. One of the most important factors causing delirium is an imbalance in the neurotransmitter levels (dopamine, gamma aminobutyric acid, serotonin). T/F/Don't know
6. Benzodiazepine/opioid medication therapy reduces the risk of delirium. T/F/Don't know
7. The longer the duration of mechanical ventilation is, the higher the risk of developing delirium becomes. T/F/Don't know
8. Non-pharmacologic approaches are not effective in the prevention of delirium. T/F/Don't know
9. Patients with limited mobility have a higher risk of developing delirium. T/F/Don't know
10. There is no relationship between delirium and changes in sensory status of the patient (hearing and vision problems). T/F/Don't know
11. As serum C-reactive protein (CRP) levels increase, the risk of delirium increases. T/F/Don't know
12. Delirium can easily be detected with a reliable measuring instrument. T/F/Don't know
13. Atypical antipsychotic treatment may reduce the duration of delirium. T/F/Don't know
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16. Changes in blood pressure (hypo/hypertension) increase the risk of delirium. T/F/Don't know
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23. Effective treatment of hypoactive delirium shortens the duration of the patient's need for a mechanical ventilator. T/F/Don't know
24. Delirium is not a factor that affects mortality in ICUs. T/F/Don't know
25. Delirium increases the cost of patient care. T/F/Don't know
26. Training and an interdisciplinary team approach are important in the effective management of delirium. T/F/Don't know

Delirium Knowledge Test Answer Key

1. Cognitive impairment reduces the risk of delirium. T/**F**/Don't know
2. Superficial sedation is a preventive approach in patients given mechanical ventilator support. **T**/F/Don't know
3. Delirium causes the patient to stay in the intensive care unit (ICU) for a longer period. **T**/F/Don't know
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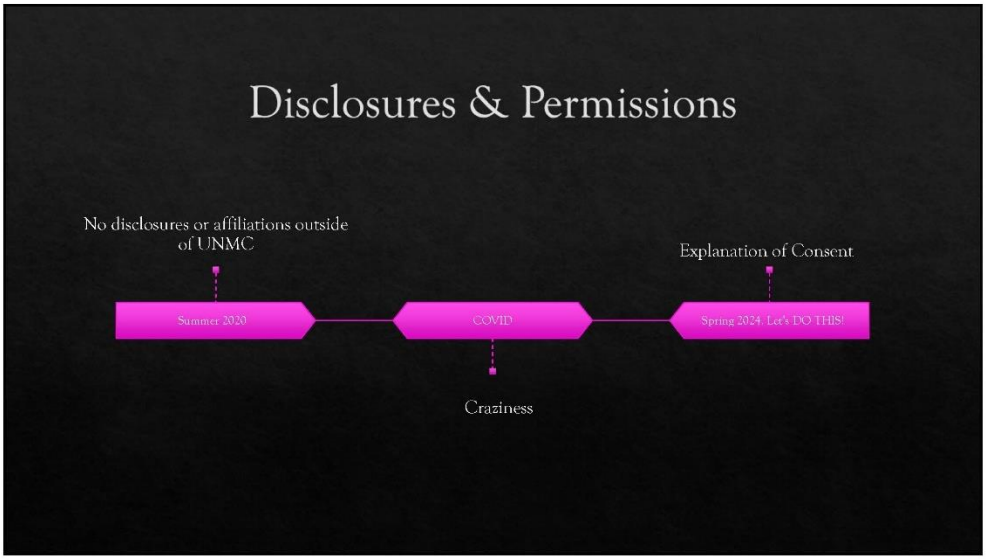
26. Training and an interdisciplinary team approach are important in the effective management of delirium. **T**/F/Don't know

Appendix E: Didactic Content for Delirium Education Intervention

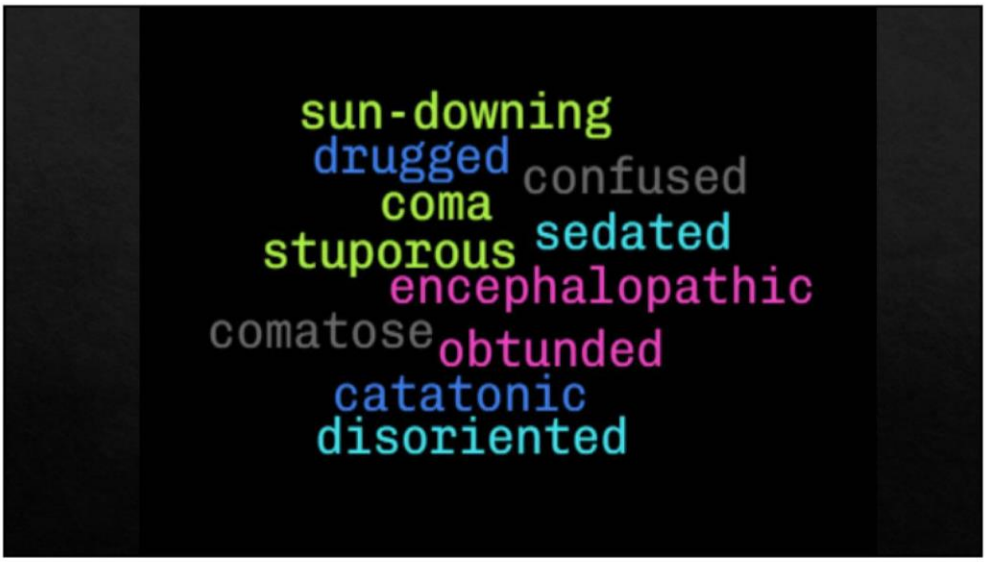


About this Pilot Study

- Explanation of risks, benefits, alternatives
- Time to complete the pretest (this is optional!) but MUCH appreciated
- Please DO NOT leave ANY BLANKS! YOU GOT THIS!!

What is Delirium??!!

- **A problem of inattention and disorientation**
- A rapid change in mental status with hallmarks of inattention and altered awareness that is fluctuating (DSM-5)
- Can not attribute to an underlying neurocognitive disorder/direct result of underlying clinical condition (Kukolja et al., 2021)
- Often confused with dementia and depression (Birge et al., 2017)



Why Do We Care??

- Most common postop side effect in elderly
- Potential cascade of additional complications
- Early recognition is key!

- Non-pharm treatments are **effective**
- Many of these fall to the bedside nursing staff~YOU

Who's at Risk?

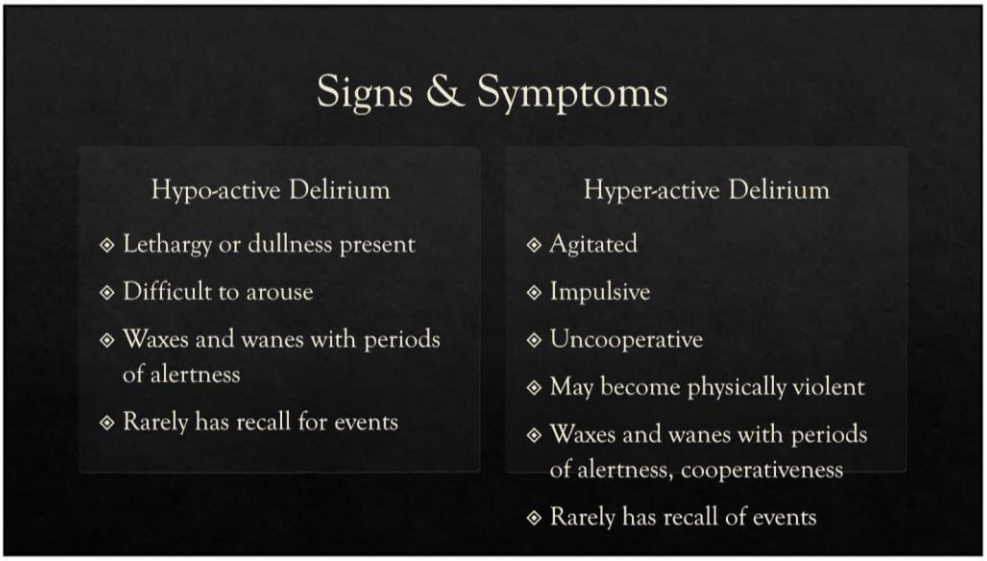
- Elderly, hospitalized
- Underlying cognitive impairment
- History of substance or etoh misuse
- Impaired hearing or vision
- Limited mobility
- Polypharmacy at baseline (meds)

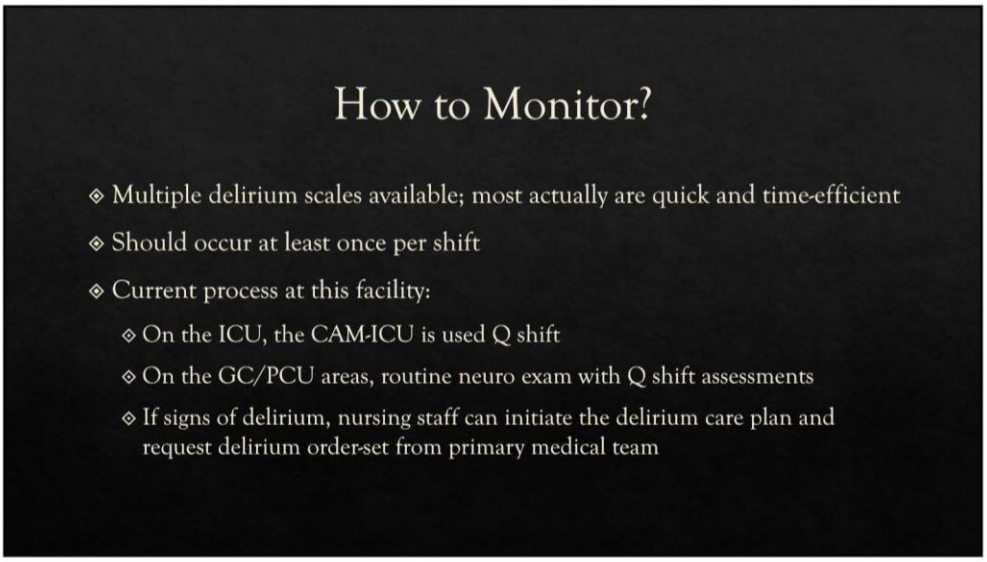
- General anesthesia
- Prolonged surgical case
- Swings in BP
- Prolonged ICU stay—critical illness, measured by increased inflammatory markers (CRP, etc). TWO WAY STREET
- Extended time on the vent

Pathophysiology

- Complex problem:
  - Involves a reversal in the function of the prefrontal cortex & the posterior cingulate cortex=changes in behavior + inattention
  - Change in brain connectivity, esp subcortex (hypothalamus)
  - Imbalance of neurotransmitters such as dopamine, gamma aminobutyric acid, serotonin
  - Also components of neuro-inflammation and even vascular dysfunction

(Lozana-Vicario et al., 2023)


Signs & Symptoms
Hypo-active Delirium
Lethargy or dullness present
Difficult to arouse
Waxes and wanes with periods of alertness
Rarely has recall for events
Hyper-active Delirium
Agitated
Impulsive
Uncooperative
May become physically violent
Waxes and wanes with periods of alertness, cooperativeness
Rarely has recall of events


How to Monitor?
Multiple delirium scales available; most actually are quick and time-efficient
Should occur at least once per shift
Current process at this facility:
On the ICU, the CAM-ICU is used Q shift
On the GC/PCU areas, routine neuro exam with Q shift assessments
If signs of delirium, nursing staff can initiate the delirium care plan and request delirium order-set from primary medical team

Early Non-Pharmacologic Interventions

- Monitoring at least Q shift
- Avoid big swings in BP
- Minimize time on vent/in the ICU if feasible
- Encourage familiar faces--visitors
- Use assist devices (hearing aids + glasses)
- MOBILIZE, MOBILIZE, MOBILIZE

Early Non-Pharmacologic Interventions Cont'd

- Lights on, shades open during day!!!
- Frequent re-orientation
- Offer toileting, nutrition, fluids routinely throughout the day
- Keep on a schedule, avoid lots of daytime napping if possible
- Offer things to keep busy (busy box, folding washcloths)

Pharmacologic Interventions/FYI

- Request assistance from providers early if patient at risk/showing early signs
- Superficial sedation while on the vent (using cautiously)
- Atypical antipsychotics (olanzapine/Zyprexa, quetiapine/Seroquel, ziprasidone/Geodon) MAY be helpful
- Melatonin at HS
- Basic work-up from primary medical team (labs looking for infectious/metabolic/toxic causes; basic imaging such as CXR)
- Depending on rapidity of onset, head imaging
- If no clear reasons, then consultation with neuro or psych

Case Study #1

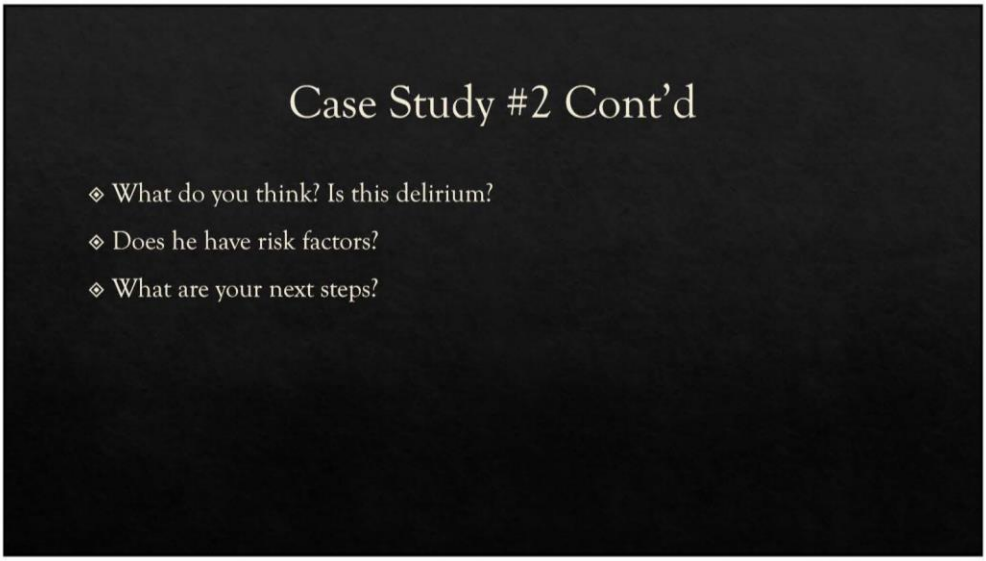
- E.W. is a 94 yo W admitted to the general surgical floor for possible gallbladder surgery. Labs, imaging, and PRN morphine are included in her admit orders
- During her initial evaluation, she was identified to have an incidental UTI and placed on Rocephin IV. Her labs also showed an elevated CRP
- Comorbidities: Mild cognitive impairment, chronic hearing loss, HTN, distant etoh, OA, previous hip replacement, uses a walker, and resides at ALF
- Her home medications include: Aricept/donezepil, HCTZ, Meloxicam, Tramadol

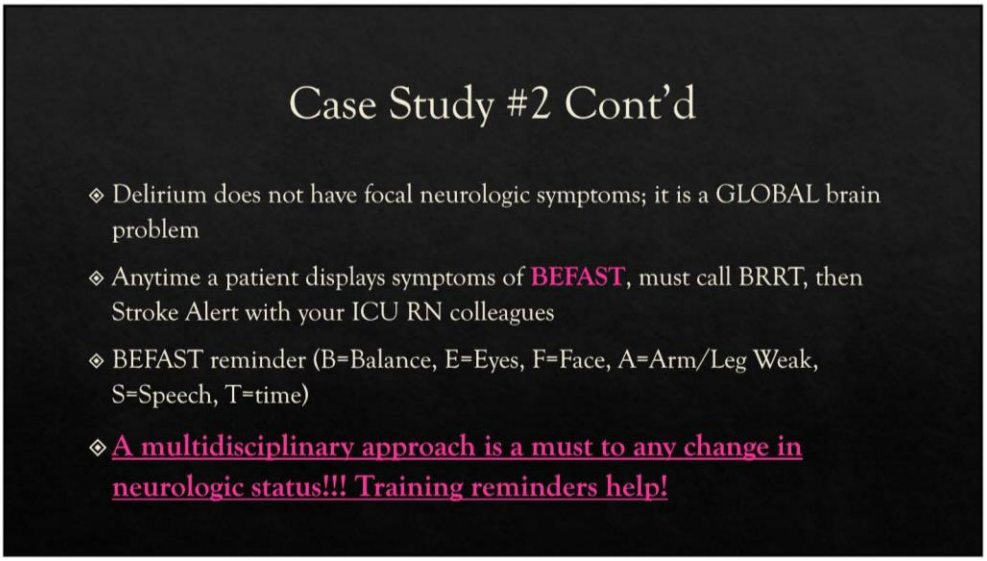
Case Study #1 Cont'd

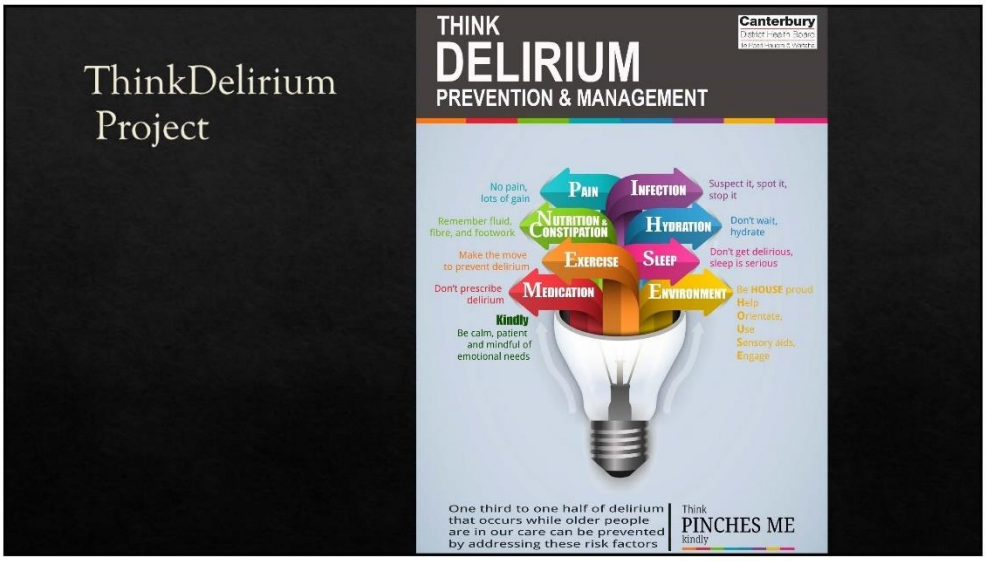
- On hospital day #2, pre-op, you notice that she seems to be picking things out of the air. On questioning, she says she is speaking with her (long-deceased) husband. On re-orientation by staff, she becomes angry
- Thoughts? How would you describe and document symptoms?
- Risk factors?
- Next steps? What can you do as bedside nursing staff?

Case Study #2

- W.R. is a 77 yo M admitted for an elective total hip replacement
- His medical hx is notable for a-fib, normally on chronic anticoagulation with apixaban/Eliquis, HTN, HLD, DM2, neuropathy. Uses a walker recently due to his hip. Lives at home independently with his significant other
- On day of admit, he had ORIF L hip, reported as uneventful peri-op
- The 4 S. Ortho unit was full and so he was transferred to the 5 S. Surgical unit
- On arrival to your unit, you notice that his speech seems slurred and he is not moving his left side as well as his right—although his surgical hip was also on the L


Case Study #2 Cont'd
What do you think? Is this delirium?
Does he have risk factors?
What are your next steps?


Case Study #2 Cont'd
Delirium does not have focal neurologic symptoms; it is a GLOBAL brain problem
Anytime a patient displays symptoms of BEFAST, must call BRRT, then Stroke Alert with your ICU RN colleagues
BEFAST reminder (B=Balance, E=Eyes, F=Face, A=Arm/Leg Weak, S=Speech, T=time)
A multidisciplinary approach is a must to any change in neurologic status!!! Training reminders help!


ThinkDelirium Project
THINK
DELIRIUM
PREVENTION & MANAGEMENT
Canterbury
No pain, lots of gain
PAIN
INFECTION
Suspect it, spot it, stop it
Remember fluid, fibre, and footwork
NUTRITION & CONSTIPATION
HYDRATION
Don't wait, hydrate
Make the move to prevent delirium
EXERCISE
SLEEP
Don't get delirious, sleep is serious
Don't prescribe delirium
MEDICATION
ENVIRONMENT
Be HOUSE proud
Help
Orientate,
Use
Sensory aids,
Engage
Kindly
Be calm, patient and mindful of emotional needs
One third to one half of delirium that occurs while older people are in our care can be prevented by addressing these risk factors
Think
PINCHES ME
Kindly

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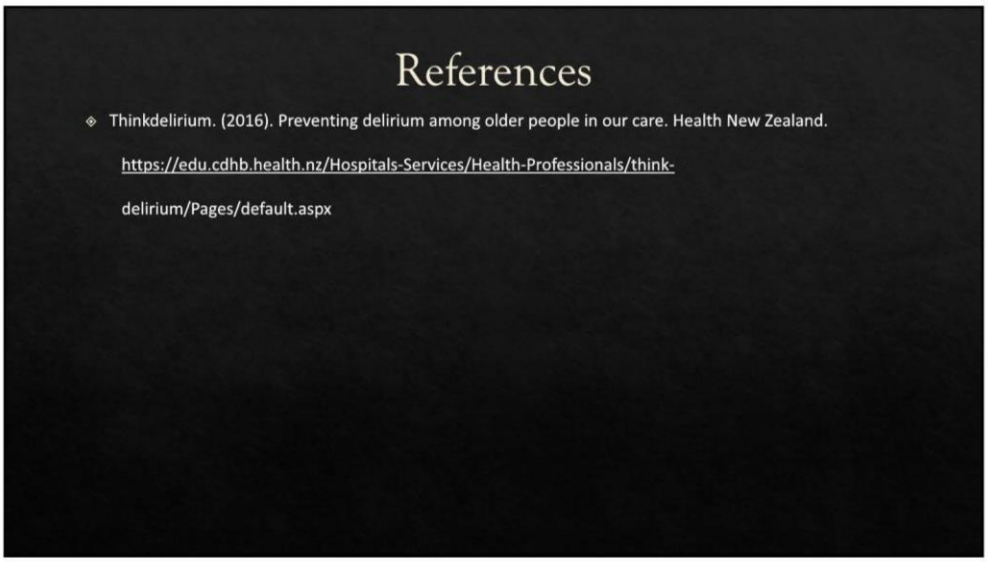
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Appendix F: Consent Form

Informed Consent for Pilot Study: "A Nursing Education Intervention on Delirium Prevention"

I am asking you to voluntarily participate in my pilot study. Please carefully read the following information, and if you agree, sign below. There are no negative consequences if you elect to not participate. You can stop participating at any time during the study.

UNMC Doctor of Nursing Practice Student Researcher: Sarah Eckles-Van Horn, MSN, APRN-NP.

Title of Project: "A Nursing Education Intervention on Delirium Prevention."

Purpose of the Project: This pilot study is being performed to determine nursing baseline knowledge on delirium. Specifically, non-pharmacologic interventions for hospitalized, postoperative, elderly patients who are at risk for delirium.

Requirements of Participants: Participants will be asked to complete a 26-question true/false pretest on delirium knowledge. Participants will then be asked to listen and interact with (an approximately 30-45 minutes) discussion on delirium and care of patients at risk for delirium. Following the discussion, participants will be asked to complete a second 26-question true/false posttest on delirium knowledge. It is vital that each pretest have the same posttest random ID number, in order to compare pre and posttest data. Participants are mandated to not work ahead on the posttest until after the delirium discussion is complete.

Potential Risks of Participating: Risks to the participant include loss of time, potential loss of confidentiality (test scores) and/or privacy of personal demographic data.

Potential Benefits of Participating: Possible benefits include improved knowledge of delirium and increased ability to care for delirium patients.

Maintaining Confidentiality: Your personal demographic information and test results will be kept confidential. Only general information regarding your nursing career is being collected. Pre and posttests will be numbered without names. Results will be kept in a secured/locked location. Data will be used for this pilot study only.

Access to Results: The researcher will develop a summary or manuscript including results and present the data to nursing staff, administration, and nursing leadership. This will include recommendations for proceeding with further delirium prevention interventions for the future, as appropriate.

By signing this form, 1) I have read and understand the above information 2) I have had the opportunity to ask questions and 3) I agree to participate in the above research study:

_____ _____

Legal Name Date/Time

Appendix G: Statistical Analyses

T-Test

[DataSet0] C:\Users\lstruwe\OneDrive - University of Nebraska Medical Center\Desktop\Summer 2024\Eckles 06.24.2024.sav

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	pre_percentage	72.1538	25	15.59472	3.11894
	post_percentage	93.3846	25	6.70967	1.34193

Paired Samples Correlations

		N	Correlation	Significance One-Sided p	Significance Two-Sided p
Pair 1	pre_percentage & post_percentage	25	.381	.030	.060

Paired Samples Test

		Paired Differences					t	df	Significance One-Sided p	Significance Two-Sided p
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper				
Pair 1	pre_percentage - post_percentage	-21.23077	14.43888	2.88778	-27.19085	-15.27069	-7.352	24	<.001	<.001

Paired Samples Effect Sizes

			Standardizer[a]	Point Estimate	95% Confidence Interval Lower	95% Confidence Interval Upper
Pair 1	pre_percentage - post_percentage	Cohen's d	14.43888	-1.470	-2.033	-.893
		Hedges' correction	14.91057	-1.424	-1.968	-.865

a. The denominator used in estimating the effect sizes.
Cohen's d uses the sample standard deviation of the mean difference.
Hedges' correction uses the sample standard deviation of the mean difference, plus a correction factor.

There was no difference in knowledge gained by educational preparation: $F(13,11) = 0.46$, p=.91, $n2$ =.35.

ANOVA

educational_prep

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	13.417	13	1.032	.462	.907
Within Groups	24.583	11	2.235		
Total	38.000	24			

ANOVA Effect Sizes[a,b]

		Point Estimate	95% Confidence Interval Lower	Upper
educational_prep	Eta-squared	.353	.000	.183
	Epsilon-squared	-.411	-1.182	-.783
	Omega-squared Fixed-effect	-.389	-1.083	-.729
	Omega-squared Random-effect	-.022	-.042	-.034

a. Eta-squared and Epsilon-squared are estimated based on the fixed-effect model.

b. Negative but less biased estimates are retained, not rounded to zero.

There was no difference in knowledge gained by years in the role, r =.77 (CI -.47, .34), p =.72.

Correlations

Correlations

Variable	Variable2	Correlation	Count	Statistic Lower C.I.	Upper C.I.	Notes
YearsinthisRole	change_score	-.077	24	-.466	.337	

Missing value handling: PAIRWISE, EXCLUDE. C.I. Level: 95.0

Correlations

Correlations

		YearsinthisRole	change_score
YearsinthisRole	Pearson Correlation	1	-.077
	Sig. (2-tailed)		.721
	N	24	24
change_score	Pearson Correlation	-.077	1
	Sig. (2-tailed)	.721	
	N	24	25